

OK TO ENTER: /MS/ 04/17/2008

Practitioner's Docket No. 3253/118**PATENT****IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re application of: Sachs

Application No.: 10/688,864

Group No.: 1722

Filed: October 17, 2003

Examiner: Song

For: Method and Apparatus for Crystal Growth

**RESPONSE UNDER
37 C.F.R. § 1.116
EXPEDITED PROCEDURE
EXAMINING GROUP
1722**

**Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450**

AMENDMENT OR RESPONSE AFTER FINAL REJECTION--TRANSMITTAL

1. Transmitted herewith is an amendment after final rejection (37 C.F.R. 1.116), including 14 sheets of replacement drawings, for this application.

STATUS

2. Applicant is other than a small entity.

EXTENSION OF TERM

3. The proceedings herein are for a patent application and the provisions of 37 C.F.R. 1.136 apply. Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition for extension of time.

FEE FOR CLAIMS

4. The fee for claims (37 C.F.R. 1.16(b)-(d)) has been calculated as shown below:

	(Col.1)		(Col. 2)		(Col. 3)	OTHER THAN SMALL ENTITY			
	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NO PREVIOUSLY PAID FOR		PRESENT EXTRA		RATE		ADDIT. FEE
TOTAL	72	MINUS	73	= 0	x	\$	50.00	= \$	0.00
INDEP	13	MINUS	13	= 0	x	\$	210.00	= \$	0
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM						+	\$	0.00	= \$ 0.00
TOTAL								\$	0.00
ADDIT. FEE									

No additional fee for claims is required.

FEE DEFICIENCY

5. If any extension and/or fee is required, charge Account No. 19-4972.

If any fee for claims is required, charge Account No. 19-4972.

Date: April 7, 2008

/Jakub M. Michna, #61,033/
 Jakub M. Michna
 Registration No. 61,033
 BROMBERG & SUNSTEIN LLP
 125 Summer Street
 Boston, MA 02110-1618
 US
 617-443-9292
 Customer No. 002101

03253/00118 853339.1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Sachs	Attorney Docket:	3253/118
Serial No.:	10/688,864	Art Unit:	1722
Filing Date:	Oct. 17, 2003	Examiner:	Song
Invention:	Method and Apparatus for Crystal Growth	Date:	Apr. 7, 2008

RESPONSE D

Dear Sir:

In response to the Final Office Action dated January 10, 2008 and pursuant to the Interview with the Examiner on March 21, 2009, the applicant submits the following amendment and remarks.

Amendment to the Claims begin on page 2 of this paper.

Amendments to the Drawings begin on page 14 and include attached replacement sheets.

Remarks begin on page 15 of this paper.

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Amendments to the Claims

Please amend claim 11, 59, 65, and 68-71 and cancel claim 73, as reflected in the following listing of claims.

Listing of Claims:

1. (Withdrawn) A method of forming a crystalline ribbon, the method comprising:
 providing a mesa crucible having a top surface and edges defining a boundary of the top surface of the mesa crucible;
 forming a melt of a source material on the top surface of the mesa crucible, edges of the melt retained by capillary attachment to the edges of the mesa crucible; and
 pulling a crystalline ribbon from the melt.
2. (Withdrawn) The method of claim 1, wherein the pulling step comprises:
 placing a seed in the melt;
 pulling the seed from the melt between a pair of strings positioned along the edges of the crystalline ribbon, thereby solidifying the melt between the pair of strings to form the crystalline ribbon; and
 continuously pulling the crystalline ribbon from the melt.
3. (Withdrawn) The method of claim 1, wherein at least a portion of a boundary profile of the melt is concave downward prior to the pulling step.
4. (Withdrawn) The method of claim 1, wherein at least a portion of a boundary profile of the melt is concave downward outside the region of the crystalline ribbon.
5. (Withdrawn) The method of claim 1, wherein pulling the crystalline ribbon from the melt forms an inflection point in a cross-sectional boundary profile of the melt.
6. (Withdrawn) The method of claim 1 further comprising forming a substantial portion of the

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melt 1 above the edges of the mesa crucible.

7. (Withdrawn) The method of claim 1 further comprising forming more than one crystalline ribbon.

8. (Withdrawn) The method of claim 5, wherein the inflection point in at least a portion of the cross-sectional boundary profile of the melt predisposes the crystalline ribbon to grow substantially flat.

9. (Withdrawn) The method of claim 1 further comprising replenishing the source material on the top surface of the mesa crucible for continuous crystalline ribbon growth.

10. (Withdrawn) The method of claim 1 further comprising controlling the temperature of the mesa crucible while forming the crystalline ribbon.

11. (Currently Amended) An apparatus for forming a crystalline ribbon, comprising:

a crucible including:

a crucible body having a top surface supporting substantially all of a melt of a source material for forming the crystalline ribbon; ~~and~~

a pair of side walls extending downward from opposing edges of the top surface, the edges formed to retain substantially all of the melt by capillary attachment to the top surface of the crucible; and

a puller for drawing the crystalline ribbon from the melt and away from the crucible body and top surface thereof.

12. (Previously Presented) The apparatus of claim 11 further comprising:

a pair of apertures defined in the crucible body, extending from the top surface to a bottom surface through the crucible body; and

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a pair of strings extending through the pair of apertures, each string positioned along an edge of the crystalline ribbon, the pair of strings defining a region within which a crystalline ribbon is formed.

13. (Previously Presented) The apparatus of claim 11, wherein the crucible adapts a portion of a boundary profile of the melt to be concave downward prior to forming a crystalline ribbon.

14. (Previously Presented) The apparatus of claim 11, wherein the crucible adapts a portion of a boundary profile of the melt to be concave downward outside the region of a crystalline ribbon.

15. (Original) The apparatus of claim 11, wherein pulling a crystalline ribbon from the melt forms an inflection point in a cross-sectional boundary profile of the melt.

16. (Previously Presented) The apparatus of claim 11, wherein a substantial portion of the melt is above the edges of the crucible.

17. (Previously Presented) The apparatus of claim 12, further comprising:

more than one pair of apertures defined in the crucible body, each pair extending from the top surface to a bottom surface through the crucible body; and

a pair of strings extending through each pair of apertures, each string positioned along an edge of a discrete crystalline ribbon, each pair of strings defining a region within which each discrete crystalline ribbon is formed.

18. (Previously Presented) The apparatus of claim 11, wherein the crucible comprises graphite.

19. (Previously Presented) The apparatus of claim 11, wherein the edges of the crucible define a recessed top surface of the crucible.

20. (Previously Presented) The apparatus of claim 11, wherein the width of the crucible is between about 15 mm and about 30 mm.

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21. (Previously Presented) The apparatus of claim 11, further comprising means for replenishing the melt on the top surface of the crucible for continuous crystalline ribbon growth.
22. (Previously Presented) The apparatus of claim 11, further comprising means for controlling the temperature of the crucible while forming a crystalline ribbon.
23. (Withdrawn) A method of forming a crystalline ribbon, the method comprising:
providing a crucible having a top surface and edges defining a boundary of the top surface of the crucible;
forming a melt of a source material on the top surface of the crucible, the melt having a boundary profile at least a portion of which is concave downward; and
pulling a crystalline ribbon from the melt.
24. (Withdrawn) The method of claim 23, wherein the pulling step comprises:
placing a seed in the melt;
pulling the seed from the melt between a pair of strings positioned along the edges of the crystalline ribbon, thereby solidifying the melt between the pair of strings to form the crystalline ribbon; and
continuously pulling the crystalline ribbon from the melt.
25. (Withdrawn) The method of claim 23, wherein the portion of the boundary profile of the melt is concave downward prior to the pulling step.
26. (Withdrawn) The method of claim 23, wherein the portion of the boundary profile of the melt is concave downward outside the region of the crystalline ribbon.
27. (Withdrawn) The method of claim 23, wherein pulling the crystalline ribbon from the melt forms an inflection point in a cross-sectional boundary profile of the melt.

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28. (Withdrawn) The method of claim 23 further comprising forming a substantial portion of the melt above the edges of the crucible.

29. (Withdrawn) The method of claim 23 further comprising forming more than one crystalline ribbon.

30. (Withdrawn) The method of claim 27, wherein the inflection point in at least a portion of the cross-sectional boundary profile of the melt predisposes the crystalline ribbon to grow substantially flat.

31. (Withdrawn) The method of claim 23 further comprising replenishing the source material on the top surface of the crucible for continuous crystalline ribbon growth.

32. (Withdrawn) The method of claim 23 further comprising controlling the temperature of the crucible while forming the crystalline ribbon.

33. (Withdrawn) The method of claim 23, wherein the width of the crucible is between about 15 mm and about 30 mm.

34. (Withdrawn) The method of claim 23, wherein the crucible is a mesa crucible.

35. (Withdrawn) A method of forming a crystalline ribbon, the method comprising:
providing a crucible having a top surface and edges defining a boundary of the top surface of the crucible;
forming a melt of a source material on the top surface of the crucible, the melt having a boundary profile; and
pulling a crystalline ribbon from the melt, thereby forming an inflection point in at least a portion of a cross-sectional boundary profile of the melt.

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36. (Withdrawn) The method of claim 35, wherein the pulling step comprises:

placing a seed in the melt; and

pulling the seed from the melt between a pair of strings positioned along the edges of the crystalline ribbon, thereby solidifying the melt between the pair of strings to form the crystalline ribbon; and

continuously pulling the crystalline ribbon from the melt.

37. (Withdrawn) The method of claim 35, wherein a portion of the boundary profile of the melt is concave downward prior to the pulling step.

38. (Withdrawn) The method of claim 35, wherein a portion of the boundary profile of the melt is concave downward outside the region of the crystalline ribbon.

39. (Withdrawn) The method of claim 35 further comprising forming a substantial portion of the melt above the edges of the crucible.

40. (Withdrawn) The method of claim 35 further comprising forming more than one crystalline ribbon.

41. (Withdrawn) The method of claim 35, wherein the inflection point in at least a portion of the cross-sectional boundary profile of the melt predisposes the crystalline ribbon to grow substantially flat.

42. (Withdrawn) The method of claim 35 further comprising replenishing the source material on the top surface of the crucible for continuous crystalline ribbon growth

43. (Withdrawn) The method of claim 35 further comprising controlling the temperature of the crucible while forming the crystalline ribbon.

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44. (Withdrawn) The method of claim 35, wherein the width of the crucible is between about 15 mm and about 30 mm.

45. (Withdrawn) The method of claim 35, wherein the crucible is a mesa crucible.

46. (Withdrawn) A method of forming a crystalline ribbon, the method comprising:
providing a crucible having a top surface and edges defining a boundary of the top surface of the crucible;
forming a melt of a source material on the top surface of the crucible, a substantial portion of the melt above the edges of the crucible; and
pulling a crystalline ribbon from the melt.

47. (Withdrawn) The method of claim 46, wherein the pulling step comprises:
placing a seed in the melt; and
pulling the seed from the melt between a pair of strings positioned along the edges of the crystalline ribbon, thereby solidifying the melt between the pair of strings to form the crystalline ribbon; and
continuously pulling the crystalline ribbon from the melt.

48. (Withdrawn) The method of claim 46, wherein a portion of a boundary profile of the melt is concave downward prior to the pulling step.

49. (Withdrawn) The method of claim 46, wherein a portion of a boundary profile of the melt is concave downward outside the region of the crystalline ribbon.

50. (Withdrawn) The method of claim 46 wherein pulling the crystalline ribbon from the melt forms an inflection point in a cross-sectional boundary profile of the melt.

51. (Withdrawn) The method of claim 46 further comprising forming more than one crystalline ribbon.

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52. (Withdrawn) The method of claim 50, wherein the inflection point in at least a portion of the cross-sectional boundary profile of the melt predisposes the crystalline ribbon to grow substantially flat.

53. (Withdrawn) The method of claim 46 further comprising replenishing the source material on the top surface of the crucible for continuous crystalline ribbon growth.

54. (Withdrawn) The method of claim 46 further comprising controlling the temperature of the crucible while forming the crystalline ribbon.

55. (Withdrawn) The method of claim 46, wherein the width of the crucible is between about 15 mm and about 30 mm.

56. (Withdrawn) The method of claim 46, wherein the crucible is a mesa crucible.

57. (Withdrawn) A method of controlling temperature of a mesa crucible while forming a crystalline ribbon, the method comprising:

- positioning an insulator comprising movable elements along a mesa crucible;
- disposing the mesa crucible in a furnace; and
- creating controlled heat leaks by moving the moveable elements of the insulator relative to the mesa crucible.

58. (Withdrawn) The method of claim 57, wherein rods connected to the moveable elements penetrate the furnace and are controlled from outside the furnace.

59. (Currently Amended) An apparatus for controlling temperature of a crucible while forming a crystalline ribbon, the apparatus comprising:

- a crucible disposed within a furnace, the crucible including:

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a crucible body having a top surface supporting substantially all of a melt of a source material for forming the crystalline ribbon, and
a pair of side walls extending downward from opposing edges of the top surface, the edges formed to retain substantially all of the melt by capillary attachment to the top surface of the crucible;
a puller for drawing the crystalline ribbon from the melt and away from the crucible body and top surface thereof;
an insulator comprising movable elements disposed along the crucible; and
means for moving the moveable elements of the insulator relative to the crucible to create controlled heats leaks from the furnace.

60. (Withdrawn) A method of replenishing a melt of a source material on a mesa crucible, the method comprising distributing a source material onto a mesa crucible, thereby reducing the heat load required to melt the source material.

61. (Withdrawn) The method of claim 60, wherein the distributing step comprises:

positioning a feeder at a distance from a mesa crucible;
moving a feeder in a first direction and a second direction along a mesa crucible; and
vibrating the feeder during motion in at least one of the first direction and the second direction, such that a source material disposed within the feeder enters a melt on the mesa crucible during such motion.

62. (Withdrawn) The method of claim 61, further comprising melting the source material prior to source material from a subsequent motion in the first direction reaching the melt.

63. (Withdrawn) The method of claim 61, wherein the distance from the mesa crucible is less than the width of the mesa crucible.

64. (Cancelled).

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65. (Currently Amended) An apparatus for replenishing a melt of a source material on a crucible, the apparatus comprising:

a crucible body having a top surface supporting substantially all of a melt of a source material for forming the crystalline ribbon; and
a pair of side walls extending downward from opposing edges of the top surface, the edges formed to retain substantially all of the melt by capillary attachment to the top surface of the crucible;
a puller for drawing the crystalline ribbon from the melt and away from the crucible body and top surface thereof;
a feeder positioned at a distance from the crucible, the feeder movable in a first direction and a second direction along the crucible; and
means for vibrating the feeder during motion in at least one of the first direction and the second direction, such that a source material disposed within the feeder enters the melt during such motion.

66. (Original) The apparatus of claim 65, wherein the feeder comprises a tube for delivering the source material to the melt.

67. (Previously Presented) The apparatus of claim 65, wherein the distance from the crucible is less than the width of the crucible.

68. (Currently Amended) An apparatus for forming a crystalline ribbon, the apparatus comprising:

a crucible for retaining a melt having a boundary profile, the crucible having:
a top surface supporting substantially all of the melt of the source material for forming a crystalline ribbon; and
a pair of side walls extending downward from opposing edges of the top surface, the edges formed to retain substantially all of the melt by capillary attachment to the top surface of the crucible; and

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a puller for drawing means for pulling the crystalline ribbon from the melt and away from the crucible body and top surface thereof, wherein at least a portion of the boundary profile is concave downward.

69. (Currently Amended) An apparatus for forming a crystalline ribbon, the apparatus comprising:

a crucible for retaining a melt having a boundary profile, the crucible having:

a top surface supporting substantially all of the melt of the source material for forming a crystalline ribbon; and
a pair of side walls extending downward from opposing edges of the top surface, the edges formed to retain substantially all of the melt by capillary attachment to the top surface of the crucible; and
a puller for drawing means for pulling the crystalline ribbon from the melt and away from the crucible body and top surface thereof, thereby forming an inflection point in at least a portion of a cross-sectional boundary profile of the melt.

70. (Currently Amended) An apparatus for forming a crystalline ribbon, the apparatus comprising:

a top surface supporting substantially all of the melt of the source material for forming a crystalline ribbon; and
a pair of side walls extending downward from opposing edges of the top surface, the edges formed to retain substantially all of the melt by capillary attachment to the top surface of the crucible; and
a puller for drawing means for pulling the crystalline ribbon from the melt and away from the crucible body and top surface thereof, wherein a substantial portion of the melt is above the edges of the crucible.

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71. (Currently Amended) A crucible comprising:

- a crucible body having a top surface supporting substantially all of a melt of a source material for forming a crystalline ribbon; and
- a pair of side walls extending downward from opposing edges of the top surface, the edges formed to retain substantially all of the melt by capillary attachment to the top surface of the crucible; and

means for pulling the crystalline ribbon from the melt and away from the crucible body and top surface thereof.

72. (Previously Presented) The apparatus of claim 71 further comprising a pair of apertures defined in the crucible body, each aperture extending from the top surface to a bottom surface through the crucible body, each aperture capable of receiving a string for forming an edge of the crystalline ribbon.

73. (Cancelled)

74. (Previously Presented) The apparatus of claim 11 wherein the top surface is substantially flat.

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Amendments to the Drawings

Formal figures accompany this response as replacement figures for the informal figures currently of record in the application. Each of the replacement figures is identified in accordance with 37 CFR §§1.84(c) and 1.121(d).

The only notable difference between the formal figures and the informal figures is that Figures 6a and 6b are labeled as “prior art” in the formal figures.

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REMARKS

The Applicant again thanks the Examiner for his analysis of the pending claims and also for his time during the interview of March 21, 2008 and for the Interview Summary of March 31, 2008 that is hereby acknowledged. Applicant requests reconsideration of the pending claims. Claim 73 is cancelled. Claims 11-22, 59, 65-72 and 74 are currently pending in the application and all stand rejected.

In summary, the most recent office action rejected the pending claims on the following grounds:

1. Claims 11-22, 59, and 68-74 are rejected under 35 U.S.C. 112, first paragraph, as failing to meet the definiteness, written description, and enablement requirements.
2. Independent claims 11, 59, 68-71, and 73 are rejected under 102(b) as anticipated by Sachs (USPN 4,627,887).
3. Claims 17, 20, and 59 as obvious in view of Sachs alone and in view of US patent 4,627,887 (Little).
4. Claim 65 -67 are rejected as anticipated by U.S. patent 5,902,395 (Nagai).

These rejections were addressed during the examiner interview held on March 21, 2008 between the applicants undersigned representatives Sam Petuchowski and Jakub Michna, and Examiners Matthew Song and Robert Kunemund. Below is a description of the substance of the interview pursuant to MPEP 713.04.

1) Rejections Based on 35 U.S.C. 112

Pursuant to the examiner interview, the Examiner has agreed to withdraw the definiteness, written description, and enablement rejections asserted against the claims.

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2) and 3) Rejections Based on Sachs, Sachs and Little

The Examiner agreed to withdraw the prior rejections based on Sachs.

4) Rejections Based on Nagai

An agreement on the Nagai rejections was not reached.

5) Finality of Rejection

The Examiner agreed to withdraw the finality of the office action of January 10, 2008 on the condition that the Applicant submit an official response to Examiner's new rejections.

6) Examiner's New Rejections

Although the Examiner withdrew the original rejections over Sachs, the Examiner presented new rejections over Sachs in light of a new interpretation of Figure 17. The Examiner's position is that Figure 17, when viewed upside down, teaches a flat surface with sidewalls extending in a downward direction. Also, the top surface holds the melt (300) by capillary attachment. The Examiner withdrew the old rejection based on Sachs and replaced them with rejections based on this new interpretation of the Sachs reference. The response to this new interpretation is presented below.

Response to Examiner's New Rejections

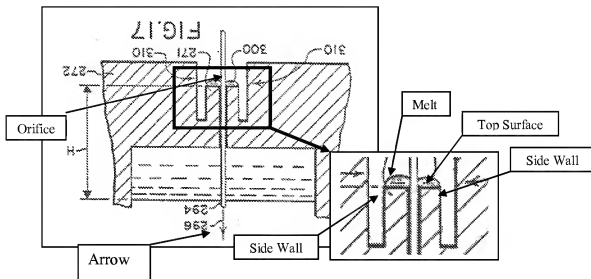
Claim 11 of the present application is directed to an apparatus for forming crystalline ribbon. The claim requires a crucible with a top surface that supports "substantially all of a melt of a source material" and "a pair of sidewalls extending downward from the opposing edges of the top surface." The opposing edges of the crucible are "formed to retain substantially all of the melt by capillary attachment to the top surface." As now amended, the claim also requires "a puller for drawing the crystalline ribbon from the melt and away from the crucible body and top surface thereof."

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The Examiner argues that, viewed upside down, Sachs' Figure 17 teaches the claimed invention. *See figure below.* More particularly, the Examiner argues that the orifice at the crucible bottom, as depicted in detail below, teaches a top surface that supports a melt and has downwardly extending sidewalls from opposing edges of the top surface.



However, Sachs does not teach a “puller for drawing the crystalline ribbon from the melt and away from the crucible body and top surface,” as now required by the amended claims.¹ Indeed, as indicated by the arrow above (296), the Sachs reference teaches pulling a string towards the “top” surface (if Figure 17 is inverted) and into the crucible body. *See Col. 16, lines 13-15 and Figure 22.* Thus, claim 11 is allowable even over the Examiner’s new interpretation of Sachs because Sachs does not teach pulling a crystalline ribbon away from the crucible body and top surface. In a similar manner, independent claims 59 and 68-71 define a similar crucible and, thus, are allowable for the same reasons. Claims 12-22, 72, and 74 depend from either

¹ See page 9, line 16 – page 10, line 7 of the specification, for a description of the “puller” feature.

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claim 11 or 71 and, thus, are allowable for the same reasons. Claim 65 was rejected over Nagai, but as amended it now requires a crucible similar to the one defined in claim 11. Thus, claim 65 and depending claims 66 and 67 are allowable for the same reasons.

All of the claims are in condition for allowance and, accordingly, issuance of a notice of allowance is requested. To further expedite prosecution, the Examiner may call Jakub Michna at 617-443-9292 if he has any further questions. If additional fees are required, please charge deposit account number 19-4972.

Respectfully submitted,

/Jakub M. Michna, #61,033/

Jakub M. Michna

Registration No. 61,033

Attorney for Applicant

BROMBERG & SUNSTEIN LLP

125 Summer Street

Boston, MA 02110-1618

Tel: (617) 443-9292

Fax: (617) 443-0004

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